

# Claims

- [c1] 1. A method for forming a nitrided tunnel oxide layer, comprising:  
forming a silicon oxide layer as a tunnel oxide layer on a semiconductor substrate;  
performing a plasma nitridation process to implant nitrogen atoms into the silicon oxide layer; and  
performing a thermal drive-in process to diffuse the implanted nitrogen atoms across the silicon oxide layer.
- [c2] 2. The method of claim 1, wherein forming the silicon oxide layer comprises performing an in-situ steam generation (ISSG) process.
- [c3] 3. The method of claim 1, wherein the plasma nitridation process utilizes  $N_2$  plasma.
- [c4] 4. The method of claim 1, wherein the plasma nitridation process is conducted under a temperature lower than 400°C.
- [c5] 5. The method of claim 1, wherein the thermal drive-in process comprises a furnace annealing process or a rapid thermal annealing process.

[c6] 6. The method of claim 5, wherein the thermal drive-in process is conducted under 850 to 1100°C for 30 seconds to 1 hour.